

## Are PBBTs used during roadside safety inspections?

In the U.S., according to Section 393.52 of the Federal Motor Carrier Safety Regulations, PBBTs that meet the Federal Motor Carrier Safety Administration functional specifications can be used for enforcement of minimum braking performance requirements on commercial motor vehicles.

For vehicles with gross vehicle weight ratings greater than 10,000 lbs., the U.S. regulations and the CVSA North American Standard Out-of-Service Criteria require that the braking force as a percentage of total vehicle weight must be at least 43.5%. Other minimum values are required in the U.S. for different commercial motor vehicle types, with values for passenger-carrying vehicles ranging from 52.8-65.3%.

For roadside inspection use of PBBTs in Canada, provincial regulations reference the CVSA North American Standard Out-of-Service Criteria's minimum total vehicle braking efficiency of 43.5%. The Canadian National Safety Code Standard 11 – Maintenance and Periodic Inspection Standards, which is the standard for conducting inspections, also sets an optional PBBT braking efficiency for each wheel end at 40% of the rated wheel weight.



The Commercial Vehicle Safety Alliance (CVSA) is a nonprofit association comprised of local, state, provincial, territorial and federal commercial motor vehicle safety officials and industry representatives. The Alliance aims to prevent commercial motor vehicle crashes, injuries and fatalities and believes that collaboration between government and industry improves road safety and saves lives. Our mission is to improve commercial motor vehicle safety and enforcement by providing guidance, education and advocacy for enforcement and industry across North America.

CVSA organizes two programs that support commercial motor vehicle brake safety in North America.

- The PBBT Users Forum provides a venue for members to discuss PBBT-related topics and issues in roadside enforcement.
- Operation Airbrake is a comprehensive program dedicated to improving commercial motor vehicle brake safety throughout North America.

The goal of both programs is to reduce the number of roadway crashes caused by faulty braking systems on commercial motor vehicles by conducting roadside inspections and educating drivers, mechanics, owner-operators and others on the importance of proper brake inspection, maintenance and operation.

For more information, visit [www.operationairbrake.org](http://www.operationairbrake.org) or [www.cvsa.org](http://www.cvsa.org).



## What are the benefits of PBBTs?

For vehicles without readily accessible brakes (e.g., low-profile tractors or trailers, motorcoaches, trucks with air disc or hydraulic brakes, and others), PBBTs provide a way to objectively assess brake function as well as braking performance, which is not feasible when conducting visual inspections alone. Examining the PBBT-measured brake forces for a vehicle can help determine:

- The origin of uneven brake lining wear problems
- Potential sources of tire wear problems
- The origin and nature of air valve or other air system problems
- The source of stability problems during braking
- An objective response to driver complaints regarding the vehicle's braking performance
- Whether a vehicle involved in a crash had adequate braking capability (in post-crash inspections)
- Whether the vehicle meets the minimum regulatory brake performance standards for the jurisdiction

Commercial Vehicle Safety Alliance

# Understanding Performance-Based Brake Testers

## Safety, Savings and Performance



# Performance-Based Brake Testers

## What is a performance-based brake tester?

A performance-based brake tester (PBBT) is a device that can assess vehicle braking capability through quantitative measurement of individual wheel brake forces or overall vehicle brake performance in a controlled test. The results provide an evaluation of a vehicle's ability to stop in its current state (e.g., brake system condition and loading condition). A PBBT can measure the brake force without restriction to:

- Vehicle type (car, truck, single unit, combination)
- Axle type (steer, drive, trailer)
- Brake type (disc vs. s-cam drum or wedge)
- Energy supply (air, hydraulic, electric, or lever and cable)

Various brake performance measuring and testing tools are used by manufacturers, technicians, fleets, researchers, enforcement officials and others interested in brake performance.

Roller dynamometer (roller-dyno) PBBTs are the predominant style used by roadside enforcement in North America. Roller-dyno PBBTs use rollers that slowly rotate each wheel end as the driver gradually increases the brake application. The rollers measure the force required to maintain constant speed (about 3-6 mph or 5-10 km/h). Each wheel end is measured independently. The vehicle remains stationary as the rollers rotate the wheels on each axle throughout the vehicle test.

Brake performance can also be assessed using mechanical or electronic decelerometers or by measuring stopping distance through a stopping performance test.

PBBTs have been used worldwide for decades for safety inspections and as part of regular preventative maintenance programs.



## What results are obtained with a PBBT and what are the benefits for motor carrier fleets?

A PBBT can provide wheel-by-wheel and axle-by-axle brake forces, which are important for:

- **Safety and Performance** – Brake force output and brake balance, which affect stopping distance, can be assessed.
- **Benchmarking** – Brakes on new vehicles and newly installed brakes can be checked to establish a baseline for future brake maintenance/lining replacement.
- **Limiting Liability** – Equipment providers can ensure the vehicles they lease or rent have adequate braking capability before they are added to an in-service fleet. Similarly, in drayage or other drive-away operations, trailers that are picked up can be checked prior to departure.
- **Air System Problems** – PBBTs can locate and identify problems within the air system. For example, a single brake with an early apply threshold can reduce lining life by two-thirds. Correcting such a problem can save hundreds of dollars per axle, per year.
- **Drum/Rotor Problems** – Out-of-round and off-center drums/rotors, affecting both brake wear and braking performance, can be found with a PBBT.
- **Parking Brake Problems** – Broken or weak spring brakes can easily be identified with a PBBT.
- **Brake Balance** – The brake forces at each wheel should optimally be in proportion to the loads on each wheel during a stop. Low brake force on one brake results in increased demand and accelerated wear on the other brakes.
- **Axle Weights** – Although not a substitute for a certified scale, PBBTs have axle-weighing capabilities.
- **Increased Throughput** – Every vehicle's brakes can be checked in a matter of minutes before it leaves the yard (or for a motorcoach, before it goes into service for the day), providing peace of mind to the fleet operator.
- **Lower Fuel Costs** – Identifying and correcting dragging brakes or bad bearings can reduce fuel consumption.

## Are the results of a PBBT consistent with a visual brake inspection?

These inspection methods assess two different things, though often they will both identify the same problems on wheel ends or axles. A PBBT measures brake forces as a percentage of axle weights as tested versus a visual inspection which examines the appearance and condition of components and brake adjustment measurements. While a visual inspection can indicate a potential problem with a brake component, in practice, the actual brake force output cannot be determined by visual inspection. The brake force measurement method is a more objective assessment of current braking capability.

For example, a lightly laden vehicle or a vehicle equipped with aggressive brake linings may meet the minimum braking efficiency requirements even while some of the vehicle's brakes are out of adjustment. On the other hand, a vehicle's brake system can appear free of violations during a visual inspection, yet fail to meet the required minimum braking efficiency (in a PBBT test) due to low-friction brake linings, overloading, air system problems or any number of other not visually apparent or "hidden" defects.

When a vehicle fails the PBBT test, it is important for the fleet maintenance provider to locate and correct the causes of the low brake force brakes to ensure the vehicle has adequate stopping capability.

## Can the same information provided by a PBBT also be obtained from a visual brake inspection?

No. While visible brake violations, such as damaged/missing components or out-of-adjustment brakes, can be found with a visual brake inspection (e.g., the North American Standard Level I Inspection), a PBBT provides additional, complementary information. A visual inspection cannot determine whether a brake has adequate braking forces. Brake performance depends not only on all components being present and in apparent good mechanical condition but, particularly, on the friction forces generated at the drum/block (or disc/pad) interface. Brakes that may appear properly functioning during a visual inspection still may not produce sufficient braking output due to contaminated or glazed linings, pressure restrictions in air or hydraulic lines, replacement linings that do not meet original equipment manufacturer (OEM) specifications, or other issues. For these reasons, jurisdictions using PBBTs often conduct a visual inspection in conjunction with a PBBT test. The two complementary inspection methods are ideal for a maintenance facility.

## Can I get the same information provided by a PBBT by performing a stopping distance test in my yard?

No. While stopping tests are the oldest quantitative method of determining overall vehicle performance, they provide limited information. The detailed brake force and balance information that help a carrier keep its maintenance costs down are not available from a stopping distance test; nor is any of the individual wheel end performance or diagnostic air system information that can be found with PBBTs.

## I have never tested a vehicle using a PBBT before. How will I know what to do?

The inspector will provide clear and simple instructions. For each axle, the driver will be asked to ensure full system air pressure is at 90 psi (620 kPa) or above and to gradually press down on the brake pedal until maximum force is applied. For the steer axle, the driver will be asked to hold the steering wheel straight ahead.

## What if my vehicle fails a PBBT test?

A failed PBBT test is a vehicle out-of-service condition and the underlying cause will need to be fixed. The PBBT compares the total vehicle brake force output to the weight on each axle. The higher the brake force generated, the higher the likelihood the vehicle passes.

As a reminder, during the test procedure, the driver should ensure the air pressure is at least 90 psi (620 kPa) and the brake pedal is depressed as firmly as possible. If the procedure was followed and the vehicle still fails the PBBT test, there are typical reasons why the brake forces may be low when compared with the vehicle weight.

First, check if the vehicle or any axles are overloaded. If so, reducing the weight will increase the brake force-to-weight ratio. After this, obvious mechanical problems, such as pushrod travel, broken or missing components, air system problems, or degraded/inadequate lining, should be checked.

PBBT test results identify the locations of poorly performing brakes. A systematic check of any poorly performing brake will nearly always find the cause of the low brake force. Repairs and/or adjustments should be made prior to putting the vehicle back in service. Nearly all brakes are required to be self-adjusting to account for normal wear. For this reason, out-of-adjustment brakes should be properly diagnosed and serviced and not merely readjusted. If a problem with the linings (e.g., glazed, low friction value, etc.) is the cause, generally, something more than a simple adjustment will be required to bring the vehicle to a safe operating condition.